Theory of regions and semi-saturated markets

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Introduction

Some insights from machine learning applied to the problem of heuristic search can help explain the rational behavior of firms that provide outside investment to technology-differentiated firms. This behavior is used to help understand regional differences for industries. We do not rely primarily on economies of scale or scope (Krugman, 1986; Baumol et al, 2000), though these would exacerbate the effects to be discussed. Scale effects, for example, if it was true that these are the largest effects today, whereby all others were mere perturbations, then this would suggest a dominant strategy of simply merging many firms, or borrowing to buy the other small firms by one of them, but there is no evidence that this strategy by itself is a dominant strategy in any market. Large firms have a better strategy of very selectively acquiring smaller firms, even very late and at enormous expense, at first glance, as a less risky way of adding profitable revenue streams, being that they acquire survivors, conditional upon assuming that survival was a relevant decision criterion in that market and they can afford it. Most firms do not acquire other firms simply because they can't — they might if they could. If so, then they are only paying for a single firm, plus a bonus to overcome transaction costs, such as persuading founders to sell, whereas had they tried to compete directly, they would have had to pay the costs of multiple firms, of which only one or two would have survived. For most probability distributions, careful, diligent, and highly selective acquisition is a better strategy, than less selective acquisitions or the merger of many small firms indiscriminately, even if we assume all those were in good health. However, we strongly agree that some economic regions rapidly move ahead of others, such that being located in a region results in substantially more growth and fewer failures, and that market imperfections, of some kind, generally create such regions. The same market imperfections, we argue, create downturns. We agree that this can be unstable as well.

Rather we argue that it is a particular use of heuristics in making outside funding decisions that creates networking effects are the most significant to the development of regions (Jackson, 2008; Jackson, 2019), especially when it comes to obtaining referrals, and subsidy effects, where certain heuristics are subsidized by presence in a region rather than anywhere else that, by the terms of the *pure* technical or economic nature of the business plan, would actually well permit. We are especially interested in such "mere" effects, that is, *mere* presence in one region, rather than another, all other things equal, sends an important signal. Usually, what happens, we argue briefly, is that there is no good way yet, to learn and identify and classify market events, in technology-dominated markets. This leads to unacceptably high risk and heuristics are used to filter the graph of events very strongly. Some heuristics happen to be subsidized by clumping in regions. These new sectors are now, in modern economies, as large as the old sectors that were larger but had less growth and were less correlated with changing technology.

1 Heuristic search

If we can assume that most modern technology, even if less costly than past technology to get started with, is more costly to complete a competitive product for the market (the point where it can be sold and revenue can result at all), and if labor wages are insufficient to fund that path for the overwhelming part of the population that participates in the labor force, then production is far more dependent on outside financial capital than in the distant past. This leads to a greater role, in the economy, for initial knowledge and search effects. One important investment strategy, *that you cannot invest, except very infrequently, in what you do not understand*, — because the major cost of investing is risk, factors that cannot be controlled by a firm that sells financial capital, — makes other heuristics and

approximate decision rules far more significant for market outcomes. If we can further assume that the driving force of an entire national economy, not just of its growth, is primarily one or more *large* new technical sectors (not a combination of one or more large old sectors and one or more small new sectors), then, apparently, most firms offering financial capital cannot invest in almost anything important, because most new technologies and sciences are not well understood by nonspecialists, yet overwhelming dependence on subject matters experts who are not themselves either the managers nor the owners of the financial capital, and do not sufficiently gain or lose but their evaluations, leads to principal and agent problems that themselves introduce excessive risk. The result is a dependence on heuristics for sparse search and for evaluation, and we may see something interesting when we recognize that some heuristics may be subsidized by subtle aspects of the market, such as regions.

Let search over a graph, from the perspective of a single firm, have the form $\mathcal{L}(G_i(e;\mathbf{m});\mathbf{m})$, where the bundle of search heuristics is a free variable, the starting point may be randomly drawn from a distribution that is predetermined by circumstances, and edges are observables, changes in the market, such as actions taken by other agents, events that trigger one of several generic actions that both produces a signal and determines, by a large variation on the produced signal (a jump), to the next event to be evaluated, generate a group in the case that a set of edges is classified, except where the method $\mathbf{m}$ is changed, and fail to generate a group in the case that a set of edges fails to be classified. Variation of the heuristics bundle, which is most likely the institutionally free variable, — all others being restricted by accepted best practices, diligence, and the latest consensus on method of performing analyses and decisions, — will eventually lead to groups, which partition a graph of related events. Even something as basic (measured in terms of absence of parameters) as the simplest random walk can sufficiently often learn the topology of a space (Varopoulos, 1984), especially a network or a tableaux, but it cannot converge on the correct conclusion rapidly enough except where the space either has a topology in one of several broad classes, specifically, at least, where there is sufficient cut-off, wherein sampling the space a surprisingly few times (that is, compared to all the possibilities) is almost the same as sampling it infinitely many times (Aldous & Diaconis, 1986). A relatively trivial aspect of topology comes into play. If you have a topological space that comprises several disjoint subspaces, it *not* possible, in too many cases, to recover without loss, or even to infer with sufficiently low error using an estimator, the topology of that space from knowledge of the topology of its subspaces (Brown, 1968). What this means is that when a situation changes, that is, when a space is extended by an additional subspace, the resulting topology is not obvious. Learning doesn't transfer, and the fallback is a bundle of rules of thumb, heuristics (Watanabe, 1969; Newell & Simon, 1970; Pearl, 1984; Watanabe, 1985).

The goal of search, because the next big market is something *new*, is to *learn*, and specifically, to identify a *sufficiently better* (above threshold) business opportunity by classifying sets of events into discrete future product classes with anticipated revenue streams. Events however are not obviously signals that test any particular conjecture about what class they belong to, and only a group-like relationship between some events under a heuristic, if the heuristic happens to be applied in the set of cases where its *biases* are not inappropriate (Mitchell 1984; Mitchell 1997), an object *seems* to be found and actually *is* found.

The market of a country that is dominated by a large new sector, focused on products differentiated by technology and marketing, is always undergoing rapid change, especially from disjoint and novel niches of product (these begin empty, such that the relevant demand was entirely ignored in the past, and consumers, previously, even in just the recent past, could not even articulate it well), and learning by experience (Sebestyen, 1962; Cooper, 1966) does not *transfer* for the most part. More precisely, given a *goal* in terms of a *risk target*, whereby risk for a given return must be $r \leq r_T(R(t,t+1))$, given specific timing (for example, Q4), learning by experience will fail to satisfy that goal. In which case, even actual "high" return is irrelevant.

Going from signal to next event depends on the free choice of heuristic to apply to events, even if the decision making rule, e.g., Wald (1947), for constructing a variation is completely fixed. When there is data, this can be easily tested in a linear or log-linear model, if the represented firm requires discounts on some actions.

The classification process described seems underdetermined and open ended, at first glance, until a budget constraint is established, but it is equally much more constrained, we might notice, if certain manners of going from signal to the next event that happens and catches attention to be evaluated ("seeking"), are subsidized.

For example, the most trivial but important case is that living near others makes it much less costly to obtain a referral; when there is not a good objective way to evaluate events, and random search until something "pops" as "related" is valid but slow, the referral is a way to reduce risk. By placing the actor with a referral as an event in the graph closer to other, already evaluated events, they are more likely to be classified as a single object or a group that corresponds to a particular market opportunity. The actor who obtains a referral has to live and interact with others in a region to increase their chances of getting it, which means they are really paying, if the region has more rapidly rising prices compared to others, to be inspected by other actors who, in the market as a graph, were already evaluated, either themselves by being referred or directly.

The problem with random search and heuristics that to do not involve "vouching" is that because technologies are mainly not well understood by those not involved with them, which is a conflict of interest, it can easily appear that a market is saturated with similar competitors, when, in fact, it is well differentiated. However, costly moving to the region and interacting with others already better

known to firms that are doing the evaluation, to provide outside capital, can be used to give a signal that the market is more differentiated and has opportunities, niches, remaining to be filled, and, most importantly, this is paid for *by* the firm seeking outside capital.

Search costs can be overwhelming when not only are there information asymmetries, but when every small group of items is unique and has to be constructed by learning, and yet might, if chosen, produce either a large reward or an enormous cost. The problem is less the asymmetry of information but that learning and information are simply not effective means of selection in such a market, even if objective and correct choices are clearly available. Yet these are dominant types of markets today. In a multisector model, the new sectors are actually as large or larger than most old sectors. Which creates regional dependence on mundane networking, that grows enormously expensive compared to all other costs.

2 "The Mere Fact" Effect

There are other factors. More interesting ones because they involve tacit signals produced simply by being located, in a verifiable way, in a region with land and housing prices that are increasing much more rapidly (Type A) than land and housing prices in other regions (Type B). For example, when a venture capital firm chooses whether to invest in a firm located in a Type A region or a Type B region, they can use the heuristic that, *sufficiently likely*, if the startup runs out of funding too quickly, that is, before it can raise the next round of funding that it needs, if the founders of the firm believe in their own business plan sufficiently, they can always save the company, and retain optionality to make good decisions, because they own land and homes that they could sell. The land and homes owned by founders who live entirely in other regions are *too likely* to be worthless from the perspective of a prospective provider of venture capital: they would be too small of a fraction of a typical round to save a firm. Rounds are approximately the same scale for all firms in all regions, given the success requirements of modern technology, but real estate value vary by orders of magnitude across regions. *The mere fact* of where a firm is located, all other things equal, because funding for startups, the drivers of most technological growth, must be sufficiently large compared to prices for land and homes in some regions, — due to the nature of current, recent past, and near future technology, — but happens to be approximately the same order of magnitude as prices for these good in other regions, all other things equal, is a strong signal of lower risk with the same return.

More precisely, startup founders in Type A region actually subsidize venture capital, by, merely by living in that region in a comfortable way, especially if they have families, This leads to an imperfect market for venture capital. Consumers are not part of the picture, because they would much rather prefer lower prices for products, but before consumers can buy a product that they actually want and are willing to pay for at the prices the firm is willing to sell for, quite profitably for some time, only startups that receive several rounds of funding make it to the point of being able to manufacture any product at all. This occurs because intermediaries exist and are important simply due to the cost of entering successfully any new sector being orders of magnitude much larger, for technical and marketing factors, than any amount that could be earned, by a randomly selected household from, say, 75% of households who participate in the labor force for a long-run time interval such as a decade, wherein technology changes completely once or more times. If you do not raise money, almost certainly, then you will almost certainly miss the requisite market timing to introduce a technology that only you and a few competitors can implement and economically sell at a profit. This often leaves money on the table for a much smaller proper subset of firms who can both raise money, for reason unrelated to their business plan or competencies, but related to the life history of their founders, *and* produce that product at all fast enough.

There are dozens of such effects, where merely being located in a region is a signal of some benefit, usually much lower risk, such as a safety net against the worse possible outcomes, that a provider of financial capital receives if they offer funding to a large degree according to region, independent of anything else, and which they, sufficiently more often than not, will not fail to receive, because being located in such a region forces, for other reasons, a founder of a firm to provide such a benefit.

Such effects are not often tested for or even conjectured. They are especially relevant to heavy industries, former new sectors that today may be old sectors, such as aerospace, energy, metallurgy, where outside financial capital opportunities are far less frequent to begin with, because these sectors are less "hot": — there is a keynesian "beauty contest" in the provision of financial capital. A firm that sells financial capital strongly prefers, for obvious reasons of taste for up to a definite level of risk and no more, to invest if and only if they believe, with a sufficiently large subjective probability, that other firms will also invest to this and future round, and soon enough. Being in a "hot" sector makes outside funding opportunities more common, such that *mere location* effects, which filter outside funding opportunities, are less significant, but whether it tends to overcome them is a more difficult question. We conjecture that, in most countries today, probably not. There tend to be startups, even though products are well differentiated, in the same "hot" new sectors, which are *also* located in Type A regions rather than Type B regions.

Conclusion

The downturn can begin when actually good market opportunities are unable to move to an established region because the mundane costs of moving a business that region are too large for actors in other regions. The pool

from which to select firms in the favored region because too small: the subsidized heuristics don't work because there are too few actual good choices remaining undiscovered. Meanwhile, those other regions experience their own downturns: they cannot get funding for something consumers, if it were funded, would actually want, and, all other things equal, is within the risk preferences of providers of financial capital.

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